

How to make energy efficiency policies in buildings deliver? – The role of refurbishment companies and skilled craft workers

Tanja Kenkmann, Öko-Institut e.V., Freiburg, Germany
Sibylle Braungardt, Öko-Institut e.V., Freiburg, Germany

ABSTRACT

In 2015, Federal Ministry for Economic Affairs and Energy published its Energy Efficiency Strategy for Buildings, based on the goal of achieving a virtually climate-neutral building stock by 2050 in line with the Federal Government's energy concept. However, despite the broad policy support for increasing energy efficiency and renewable energies in buildings, Germany is falling short of delivering the progress needed for meeting the targets. While there is an extensive literature on the various economic and non-economic barriers to energy efficiency, the role of skilled craft workers as important actors in increasing energy efficiency and renewable energy shares in buildings has been discussed only marginally. The paper confirms previous estimates of the order of magnitude of additional workers that would be needed to meet the renovation targets. In parallel and drawing on an online survey with more than 300 home owners, our study analyzes the extent to which difficulties to find skilled craft workers and/or get adequate offers can be a barrier to renovation works, also comparing with the importance of other possible types of difficulties encountered (from the building owner's perspective).

Introduction

The German energy concept outlines the long-term strategy and the guiding principles towards achieving the triple objective of security of supply, affordability and environmental compatibility (BMW, 2010). Within the energy concept published in 2010, the German government committed to reducing primary energy consumption by 20% in 2020 and by 50% in 2050 as compared to the 2008 levels.

For the energy consumption of buildings, the German energy concept defines a target of -20% for final energy consumption for heating and -80% of primary energy consumption in 2050 with respect to the 2008 levels. The energy concepts highlights the relevance of the building sector, accounting for around 40% of the total energy consumption and showing large potentials for reducing CO₂ emissions.

Figure 1 shows the primary energy consumption for heating as compared to the 2050 target. The trend lines shown in the figure indicate that average annual reductions of almost 4% would be necessary in order to reach the 2050 target. The final energy consumption is displayed as reported in the annual monitoring reports published by the Federal Ministry for Economic Affairs and Energy and does not account for climate corrections.

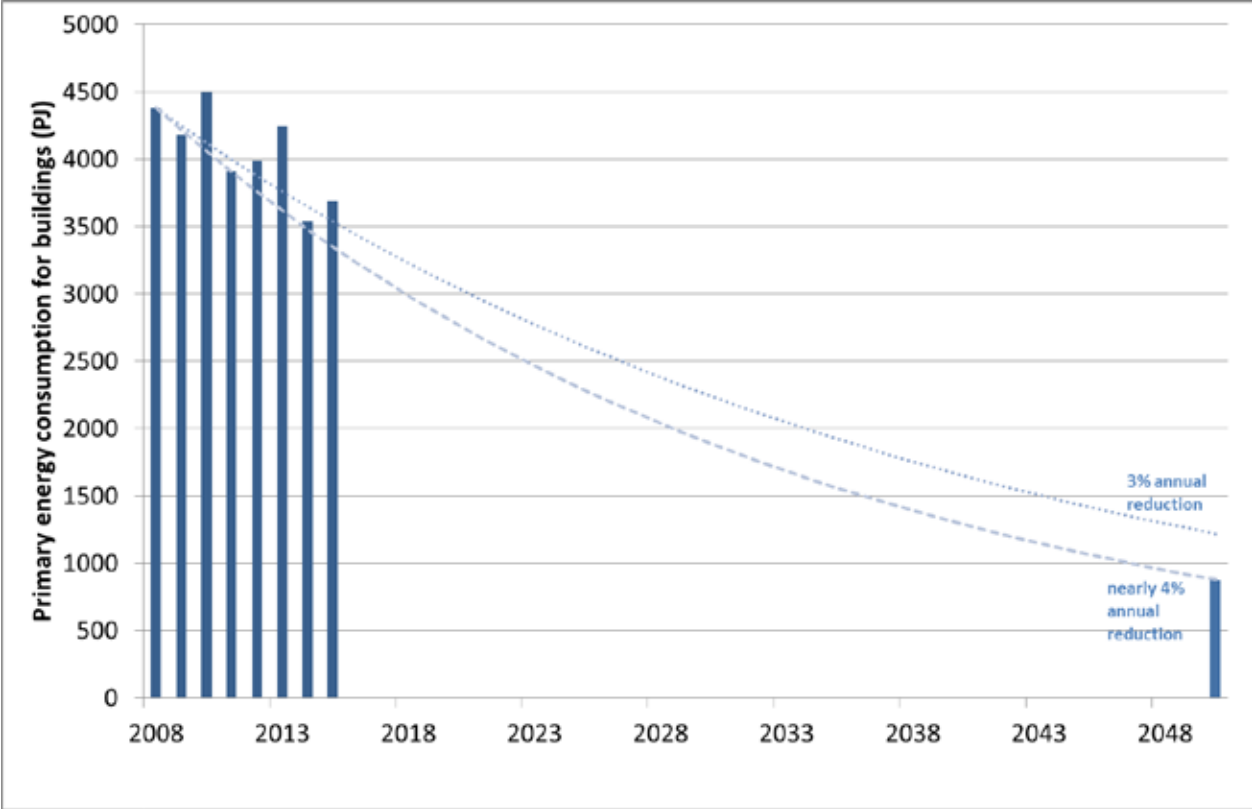


Figure 1: Primary energy consumption for heating and target for 2050

Figure 2 shows the development of final energy consumption for heating since 2008 and compares it to the 2020 target. The comparison indicates that a considerable increase in energy related building refurbishment would be necessary in order to reach the 2020 target.

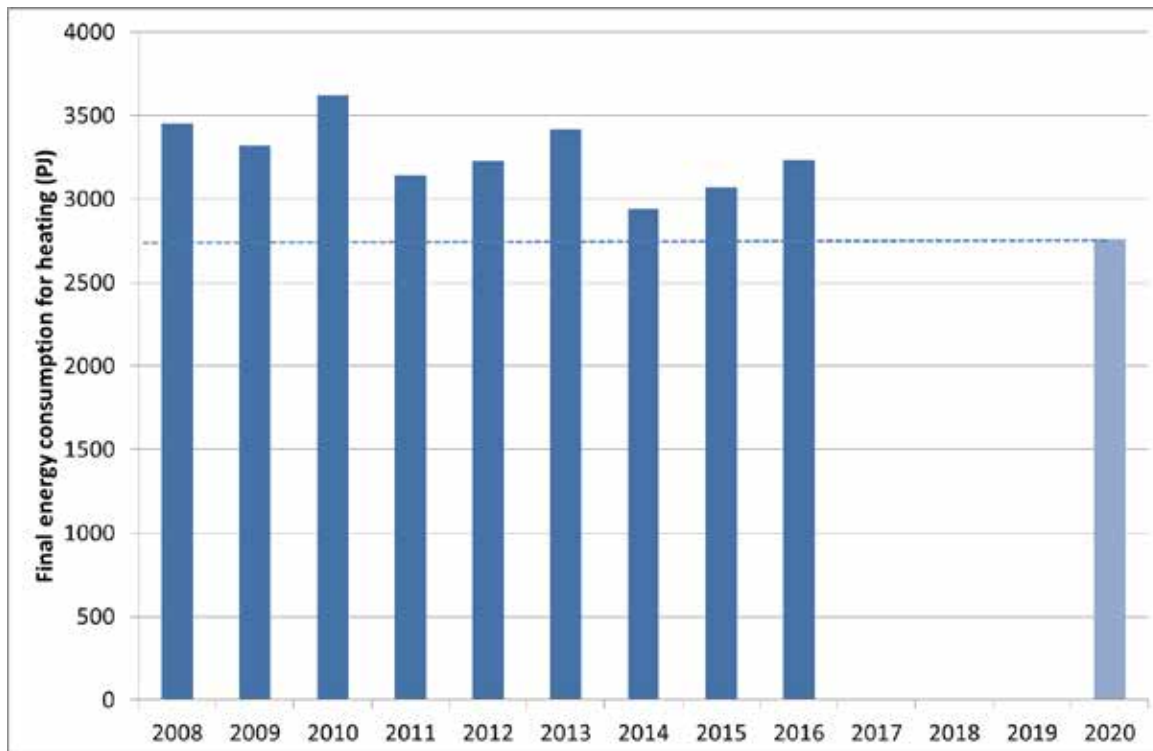


Figure 2: Final energy consumption for heating and target for 2020.

In 2014 the Federal Government launched the National Action Plan on Energy Efficiency (NAPE), a comprehensive strategy covering all sectors and a variety of actors (BMW, 2014). The NAPE aimed at closing the gap to the 2020 target, where stepping up energy efficiency in buildings is one of the key pillars. In 2015, the Federal Ministry for Economic Affairs and Energy published its Energy Efficiency Strategy for Buildings (BMW, 2015), outlining the strategic approach for achieving a virtually climate-neutral building stock by 2050 in line with the Federal Government's energy concept.

A variety of studies have estimated the additional activities in energy-related building refurbishment that would be necessary to achieve the targets of the German Energy Concept. All energy consumption or climate protection scenarios that show paths to achieving the climate goals by 2050 find that a significant increase in the annual refurbishment rate of the existing building stock is required (see e.g. Dena, 2017, BCG & Prognos, 2018, Fraunhofer ISI et al., 2017, Bürger et al., 2016, Öko-Institut & Fraunhofer ISI, 2015). With a current retrofit rate of approximately 1%, depending on the scenario and the time period, the estimated required retrofit rates range from an increase to 1.4% annually on average in 2015-2050 (Dena 2017) to 3.9% annually between 2041 and 2050 in the climate change scenario -95% in Öko-Institut & Fraunhofer ISI (2015).

The current policy instruments in Germany for the promotion of energy-efficient building renovation usually aim at motivating, informing and advising building owners and at providing financial support for the renovation measures. Such policy measures implicitly assume that skilled craft professionals are available for the implementation of the renovation measures. In this context, the political discussion has frequently described the opportunities for the refurbishment market in the energy transition and the positive effects on regional value added and the economy (for example Kornhardt & Kowald, 2010, DHI, 2016, Weiß et al., 2014).

However, there are increasing indications that a shortage of skilled craft professionals may pose considerable challenges on the refurbishment market, in particular if refurbishment activities are increased in order to meet the energy efficiency targets. The Build Up Skills initiative¹ published a detailed analysis of the projected demand and supply of skilled craft professionals in 2012 (Weiß&Rehbold, 2012). The study concludes that while no nationwide shortage of skilled workers is expected until 2020, shortages are expected after 2020 and may occur even before 2020 in some selected professions and regions (ZDH, 2012). Recently, shortages of skilled craft professionals for the implementation of measures, also outside the area of thermal refurbishment, are regularly addressed in the media. In December 2017, the German Confederation of Skilled Crafts (ZDH) described the shortage of skilled workers and junior staff as an obstacle to growth in the trades². The Confederation of Skilled Crafts in Baden-Württemberg found in its survey on skilled labor demand in the third quarter of 2017 that the proportion of companies in the finishing industry³ looking for skilled workers has risen from 24% in 2011 to 31% in 2017 and reaches up to 44% in the main construction industry⁴. In absolute numbers, the Baden-Württemberg finishing industry currently lacks 20,000 skilled workers (BWHT, 2017). Since the finishing trade is structured on a small-scale basis, almost two-thirds of the companies have less than five employees (Destatis 2011 to Destatis 2017), such that the search for personnel is particularly difficult.

The paper discusses the following two research questions:

- 1) What is the size of the gap between the currently available skilled crafts workforce and the workforce that would be needed in order to meet the German energy and climate targets?
- 2) What is the effect of the shortage of skilled craft workers in the current retrofit market?

The first research question is analysed by collecting statistical data on the current labour market for the skilled crafts companies relevant for building retrofit and comparing it to an estimate of the future labour demand. The estimate is based on existing studies quantifying the investments needed and recent data on the labour productivity of the sector.

The second research question is analysed using data of a survey conducted among owners of single- and two family homes in Germany in October 2017.

Methodological approach and data

This section describes our methodological approach for addressing the two research questions.

Demand for skilled workers and estimation of gap

We estimate the gap between the current labour market for skilled craft workers and the necessary workforce needed to achieve the targets adopted in the German Energy Concept by

¹ www.bauinitiative.de

² <http://www.spiegel.de/wirtschaft/unternehmen/handwerker-branche-klagt-ueber-fachkraeftemangel-a-1184614.html>

<https://www.heise.de/newsticker/meldung/Fachkraeftemangel-bremst-Wachstum-im-Handwerk-3926891.html>

³ The finishing industry covers most trades involved in post construction fitting/finishing work, repairs and maintenance.

⁴ The main construction trades cover all companies responsible for actual construction work.

comparing the additional workforce requirements to the current skilled crafts labour market (see Figure 3).

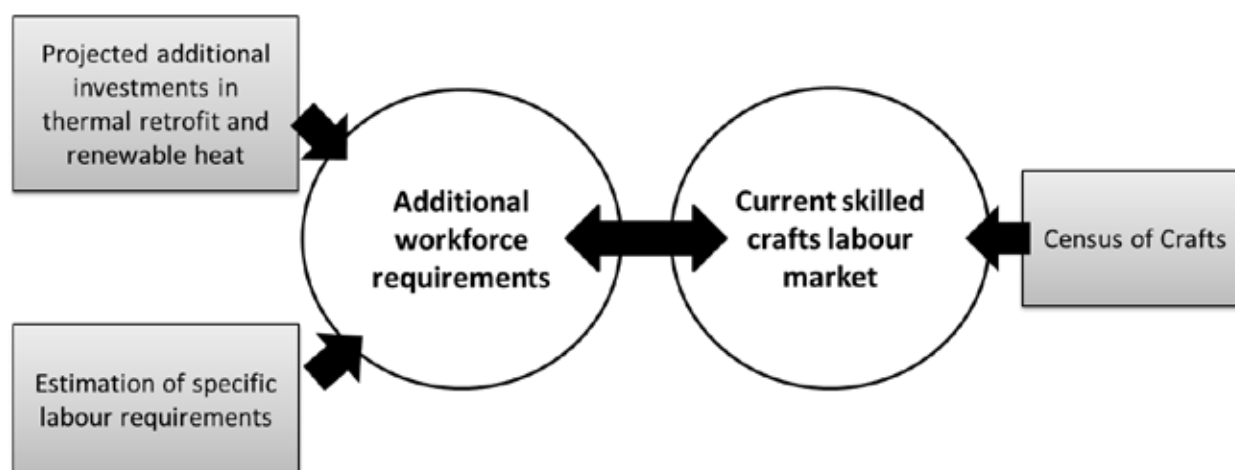


Figure 3: Schematic representation of methodological approach to estimate the gap between the additional workforce requirements and the current skilled crafts labour market.

The analysis is based on the following data sources:

- We use the recent projections published by the German Energy Agency in 2017 (Dena 2017) to estimate the **additional annual investments** that would be required to achieve the targets in the building sector. The additional investments are calculated with respect to a reference scenario.
- The **specific labour requirements** are estimated from various monitoring reports of the KfW programmes for energy efficient refurbishment and construction (Diefenbach (2011), Diefenbach (2013, korrigierte Fassung, 2014), Diefenbach (2014), Diefenbach (2015), Diefenbach (2016)). The reports use an input-output model to estimate the employment effects of the retrofit measures that retrieve subsidies in the KfW programmes.
- The data on the **current labour market** are retrieved from the Census of Crafts provided by the German Statistical Office (Destatis 2009-2015) and Destatis (2018).

Influence of skills shortage on current retrofit market

We analyse the role of shortages in the skilled craft workforce for the current building retrofit market by analyzing the results of a survey with homeowners that was conducted in October 2017. The survey was implemented via computer assisted web interviews (CAWI), using a panel of owners of single-family and two-family homes in Germany provided by co2online⁵. The questionnaire was sent by email to a total of around 57000 home owners and was completed by 300-350 participants after applying a filter question to only select homeowners that had contracted or had tried to contract skilled craft companies to perform thermal retrofit measures within the past five years. The survey contained various questions related to the difficulties that homeowners may encounter in the process of contracting skilled crafts companies. The aim of the survey was not to obtain quantitative results based on a representative sample but to gain insights on how building owners perceive the shortage of skilled craft professionals. The results of the survey were discussed in a stakeholder workshop with 15

⁵ www.co2online.de

participants from skilled crafts trade associations, the skilled craft union and the scientific community in November 2017.

Results

Skilled-craft workers – status quo

Table 1 shows the development of workers in selected skilled craft trades. The workforce has augmented in all of the selected trades, with differing growth rates between the different trades.

Table 1: Number of employees of selected skilled craft trades

	Installations of gas, water, HVAC	Stucco working and plastering	Glazing and painting
2009	307,433	36,206	166,533
2010	309,974	35,932	166,832
2011	311,852	36,463	168,899
2012	317,529	36,798	166,372
2013	320,401	37,093	164,457
2014	322,253	39,785	171,920
2015	321,616	39,476	170,093

Source: Öko-Institut based on Destatis (2011-2015)

Estimation of additional demand for skilled craft workers

As described in Figure 3, the additional demand for skilled craft workers is estimated by multiplying the additional investments with the specific employment per Euro invested. The additional investments are derived from Dena (2017), where the annual investments needed to achieve the energy and climate goals are calculated with respect to a reference scenario. The study estimates additional annual investments of around 12 Mrd Euro. The specific workforce is projected on the basis of the figures presented in Table 2, where it is assumed that the decreasing trend continues until 2020.

Note that the calculations are rough estimates assuming a similar average rate of jobs per amount of investment for all types of trades, and assuming that this rate is linearly proportional to the amount of investment, where it is assumed that the type of investments are similar to the ones induced by the current KfW programmes.

Table 2: Specific workforce

	2010	2011	2012	2013	2014	2015
Additional employees per 100 Mio Euro net investments	1,038	1,039	937	886	945	911

Source: Diefenbach (2011), Diefenbach (2013, korrigierte Fassung, 2014), Diefenbach (2014), Diefenbach (2015), Diefenbach (2016)

Figure 4 displays the estimated additionally required workforce that would be necessary in order to achieve the climate and energy goals. We estimate an average additional workforce of 104,000 in 2020 by multiplying the additional investments from Dena (2017) with the specific workforce (Table 2).

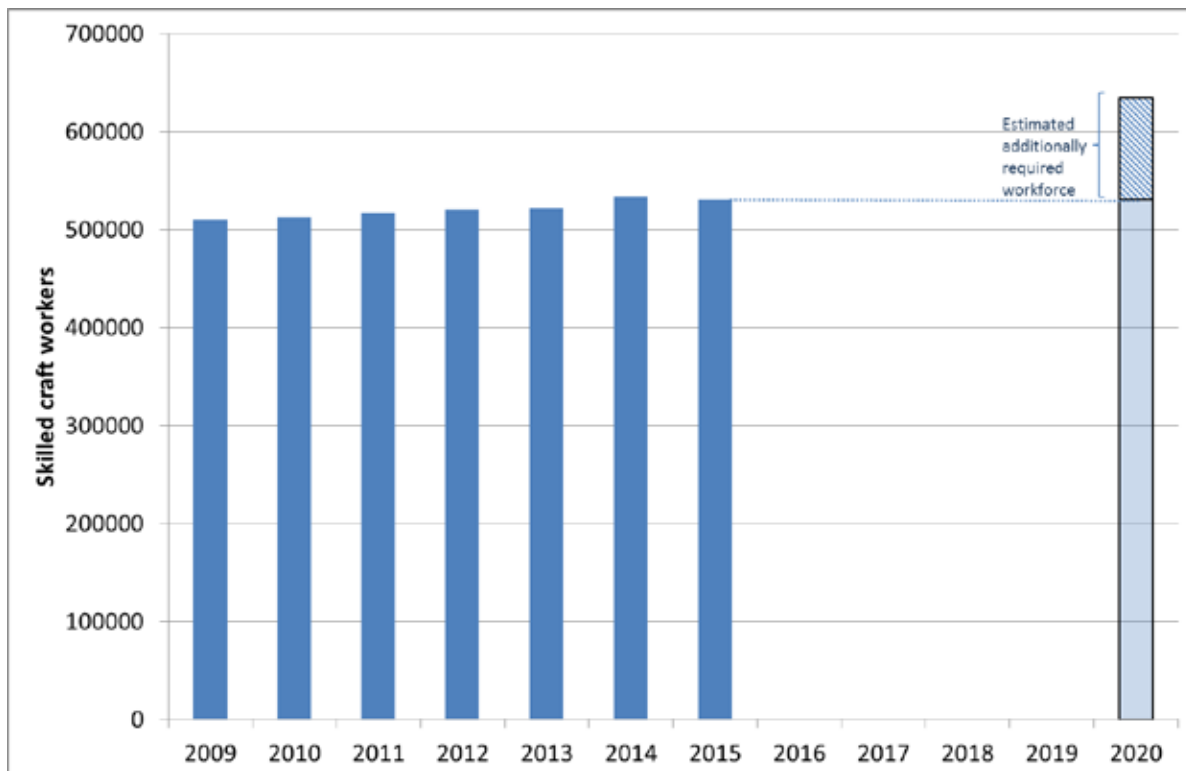


Figure 4: Status quo of skilled craft workers in the selected trades (see Table 1) in Germany and estimated additionally required workforce that would be needed in order to meet the German climate and energy goals.

We compare the estimated additional required workforce of 104,000 workers to the employment effects estimated in Öko-Insitut & Fraunhofer ISI (2015), where ambitious climate protection scenarios are calculated and compared to a reference scenario. For the construction sector, the study finds sectoral employment changes of 3.5-4% as compared to the reference scenario (Hartwig, 2016). With a total of around 3 Mio workers in the reference scenario, the additional required workforce is calculated to around 120,000. The effect is thus of the same order as the assessment shown in Figure 4.

The role of shortages of skilled craft professionals on the current retrofit market

The survey conducted among home owners provides insights into the perceived difficulties to find adequate skilled craft professionals to implement retrofit measures. When asked about the role of different limiting factors in the implementation, the survey participants rated the difficulty of finding skilled craft workers as similarly important as other aspects such as financial constraints and discomfort in the implementation (Figure 5).

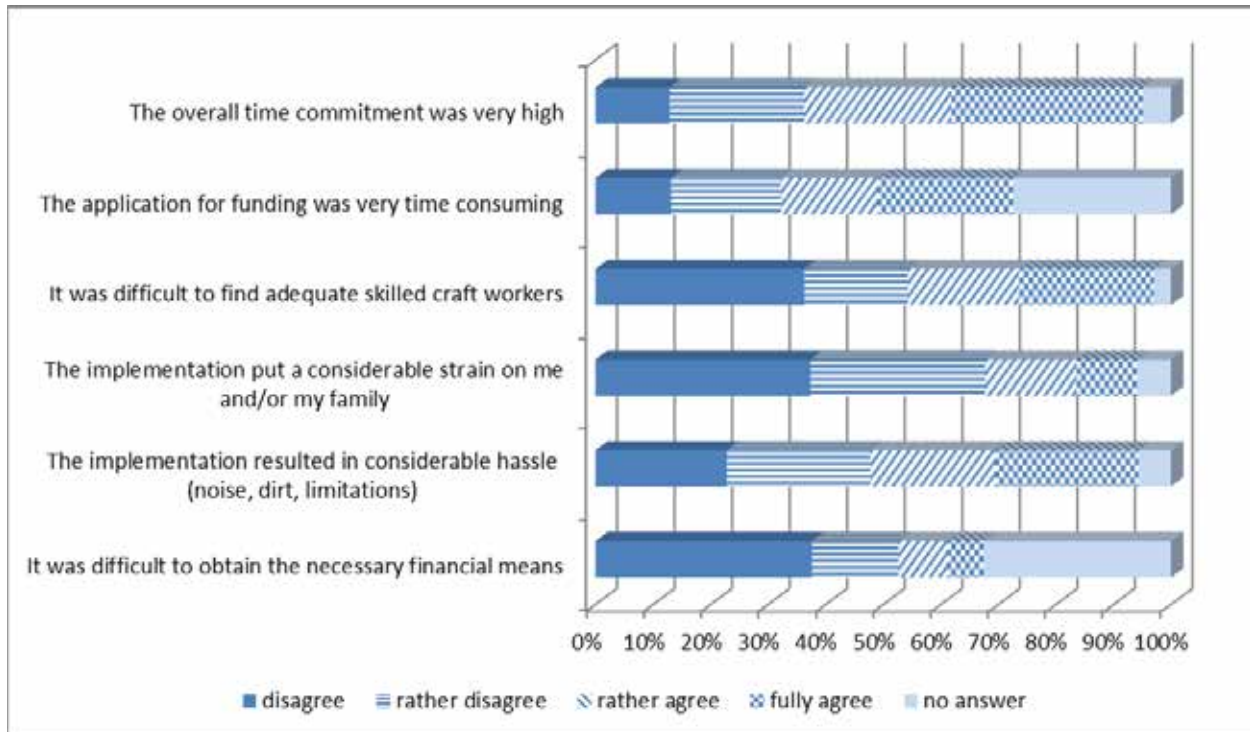


Figure 5: Rating of experiences with the implementation of retrofit measures.

When explicitly asked about their experiences with obtaining adequate offers from skilled craft professionals, 8% of the participants fully or rather agree to the statement that they could not obtain an adequate offer despite serious efforts.

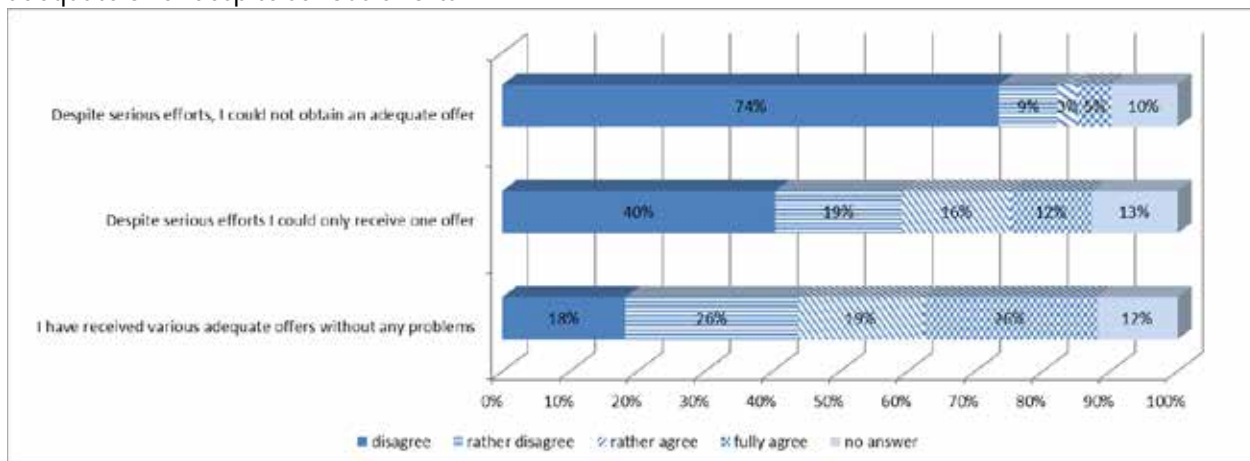


Figure 6: Rating of experiences with obtaining offers from skilled craft professionals

The participants were furthermore asked about the number of skilled craft professionals that they contacted and the total number of offers that they received. Around one third of the participants obtained less offers than requests. The most frequently stated reasons for not receiving offers were a high workload and a lack of interest from the skilled craft companies.

While 243 participants stated that they have implemented the measure(s) and 55 participants stated that the implementation is planned for the near future, only 15 participants stated that the originally

planned measure(s) have not been implemented. Among these 15 participants, four state that the difficulties in finding skilled craft professionals was the main reason for not implementing the measure(s).

Discussion and conclusions

Germany cannot reach its energy and climate targets in the building sector without addressing the shortage of skilled crafts professionals. Meeting the targets would require at least a doubling of the current refurbishment rate, leading to a considerable demand for skilled craft workers. The current policy measures to increase the rate of refurbishment cannot achieve the desired effect if the skilled craft professionals are unavailable as implementers.

Based on recent scenario projections for the German buildings sector, the paper provided an estimate of the number of skilled professionals that would be needed to reach the target. The study confirms that the risk of shortage in skilled professionals could create a bottleneck to meet the targets. As shortages are likely to differ between different trades and between different regions, more disaggregated and detailed data would be needed to refine the estimates per building trade, qualification and region.

Through a survey conducted with homeowners that contracted or had tried to contract renovation works in the past five years, the paper highlights the owner-perspective and contributes insights about how difficulties in finding professionals influence decision-making for building retrofit. The time commitment associated with thermal retrofit measures is an important barrier and continues to increase due to the high outlay required for the search for skilled crafts professionals.

For further research it would be interesting to further focus on homeowners that have tried to conduct renovation projects but did not implement the measures due to a lack of skilled craft professionals. As the survey took an explorative approach and did not apply quota sampling for different sub-groups the sample size of homeowners that have implemented measures largely exceeds the one of homeowners that gave up during the planning process, such that a sound comparison is not possible.

While the availability of skilled craft professionals is a prerequisite for the implementation of the energy transition, an ambitious and stable policy framework is also a prerequisite for the development of new market strategies and business models for skilled craft professionals.

In order to achieve the German energy and climate goals, further efforts are required to address not only the number of professionals available for renovation works but also the additional qualifications needed to implement ambitious measures. Based on the successful existing initiatives such as the BUILD UP Skills initiative, further efforts are needed to bring together the relevant stakeholders and to design strategies to ensure the availability of skilled craft professionals for implementing the energy transition.

References

- Baden-Württembergischer Handwerkstag (BWHT) (2017). Umfrage zum Fachkräftebedarf 3. Quartal 2017.
- BMWI (2010). Energiekonzept für eine umweltschonende, zuverlässige und bezahlbare Energieversorgung. https://www.bmwi.de/Redaktion/DE/Downloads/E/energiekonzept-2010.pdf?__blob=publicationFile&v=3.

- BMWi (2014). Making more out of energy efficiency – National action plan on energy efficiency. https://www.bmwi.de/Redaktion/EN/Publikationen/nape-national-action-plan-on-energy-efficiency.pdf?__blob=publicationFile&v=1
- BMWi (2015). Energy Efficiency Strategy for Buildings - Methods for achieving a virtually climate-neutral building stock. https://www.bmwi.de/Redaktion/EN/Publikationen/energy-efficiency-strategy-buildings.pdf?__blob=publicationFile&v=6
- Boston Consulting Group (BCG) & Prognos (2018). Klimapfade für Deutschland. https://www.zvei.org/fileadmin/user_upload/Presse_und_Medien/Publikationen/2018/Januar/Klimapfade_fuer_Deutschland_BDI-Studie_/Klimapfade-fuer-Deutschland-BDI-Studie-12-01-2018.pdf
- Bürger, V.; Hesse, A.; Palzer, A.; Köhler, B.; Herkel, S. & Engelmann, P. (2016). Klimaneutraler Gebäudebestand 2050. Endbericht (Climate Change 06/2016). Dessau-Roßlau: Umweltbundesamt (UBA).
- Dena (2017). Szenarien für eine marktwirtschaftliche Klima- und Ressourcenschutzpolitik 2050 im Gebäudesektor (Deutsche Energie-Agentur GmbH (dena), Hrsg.), Berlin.
- Destatis (2009-2017). Census of Crafts. Available at the online portal of the German Statistical Office. <https://www-genesis.destatis.de/genesis/online/logon?language=de&sequenz=statistikTabellen&selectionname=53111>.
- Destatis (2018). Press release of the German Statistical office. Available online at https://www.destatis.de/DE/PresseService/Presse/Pressemitteilungen/2018/03/PD18_087_53211.html
- DHI (2016). Deutsches Handwerksinstitut: Die Energiewende – Chancen Risiken und Handlungsbedarfe im Handwerk. Ein Handbuch mit Handlungsempfehlungen für Betriebe und Handwerksorganisationen.
- Diefenbach, N. et. al. (2011). Monitoring der KfW-Programme „Energieeffizient Sanieren“ 2010 und „Ökologisch / Energieeffizient Bauen“ 2006 - 2010. Darmstadt, Bremen: Arbeitsgemeinschaft Institut für Wohnen und Umwelt (IWU) und Bremer Energie Institut (BEI).
- Diefenbach, N. et. al. (2013, korrigierte Fassung, 2014). Monitoring der KfW-Programme "Energieeffizient Sanieren" und "Energieeffizient Bauen" 2012. Darmstadt, Bremen: Arbeitsgemeinschaft Institut für Wohnen und Umwelt (IWU) und Fraunhofer IFAM.
- Diefenbach, N. et. al. (2014). Monitoring der KfW-Programme "Energieeffizient Sanieren" und "Energieeffizient Bauen" 2013. Darmstadt, Bremen: Arbeitsgemeinschaft Institut für Wohnen und Umwelt (IWU) und Fraunhofer IFAM.
- Diefenbach, N. et. al. (2015). Monitoring der KfW-Programme "Energieeffizient Sanieren" und "Energieeffizient Bauen" 2014. Darmstadt, Bremen: Arbeitsgemeinschaft Institut für Wohnen und Umwelt (IWU) und Fraunhofer IFAM.

- Diefenbach, N. et. al. (2016). Monitoring der KfW-Programme "Energieeffizient Sanieren" und "Energieeffizient Bauen" 2015. Darmstadt, Bremen: Arbeitsgemeinschaft Institut für Wohnen und Umwelt (IWU) und Fraunhofer IFAM.
- Fraunhofer ISI; Consentec GmbH & Ifeu (2017). Langfristszenarien für die Transformation des Energiesystems in Deutschland. https://www.bmwi.de/Redaktion/DE/Downloads/B/berichtsmodul-1-hintergrund-szenarioarchitektur-und-uebergeordnete-rahmenparameter.pdf?__blob=publicationFile&v=4
- Hartwig, J., Kockat, J., Schade, W. and Braungardt, S. (2017). The macroeconomic effects of ambitious energy efficiency policy in Germany - Combining bottom-up energy modelling with a non-equilibrium macroeconomic model. *Energy* 124 p.510-520.
- Kornhardt, U. & Kowald, C. (2010). Marktpotenziale des Handwerks durch den Gebäudeenergieausweis (Göttinger handwerkswirtschaftliche Arbeitshefte, Bd. 65). Duderstadt: Mecke.
- Öko-Institut and Fraunhofer ISI (2015). Klimaschutzszenario 2050, 2. Endbericht. Berlin: Study on behalf of the BMUB; 2015. <https://www.oeko.de/oekodoc/2451/2015-608-de.pdf>.
- Weiß & Reibold (2012). BUILD UP SKILLS – Germany. <https://ec.europa.eu/energy/intelligent/projects/en/projects/build-skills-de>
- Weiß et al. (2014). Kommunale Wertschöpfungseffekte durch energetische Gebäudesanierung (KoWeG). IÖW, Ecofys, zuletzt abgerufen am 15.03.2018.
- Zentralverband des Deutschen Handwerks (ZDH) (2012). http://www.bauinitiative.de/fileadmin/user_upload/bilder/Dokumente/Qualergy2020-The-German-Project.pdf